BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
FACULTY OF MECHANICAL ENGINEERING

SUBJECT DATASHEET

I. SUBJECT DESCRIPTION

1. GENERAL DATA

1.1. Subject name (in Hungarian, in English)

Applied Fluid Mechanics and Acoustics ● Applied Fluid Mechanics and Acoustics

1.2. Neptun code

BMEGEÁTNG03

1.3. Type

study unit with contact hours

1.4. Course types and number of hours (weekly / semester)

course type	number of hours (weekly)	nature (connected / stand-alone)
lecture (theory)	4	-
exercise	1	coupled
laboratory exercise	1	coupled

1.5. Type of assessments (quality evaluation)

exam

1.6. ECTS

7

1.7. Subject coordinator

name:	Dr. Benedek Tamás (76511246251)
post:	adjunct
contact:	benedek@ara.bme.hu

1.8. Host organization

Department of Fluid Mechanics (http://www.ara.bme.hu/)

1.9. Course homepage

http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNG03

1.10. Course language

hungarian

1.11. Primary curriculum type

mandatory

1.12. Direct prerequisites

Strong prerequisite: -

Weak prerequisite: -

Parallel prerequisite: -

Milestone prerequisite: -

Excluding condition: -

(the subject cannot be taken if you have previously completed any of the following subjects or groups of subjects)

2. AIMS AND ACHIEVEMENTS

2.1. Aim

To acquaint students with the following topics, especially their energy application: Application of fluid principles in mechanical systems and technological processes, especially industrial air and gas technology: grouping of machines, operating characteristics, construction, sizing, selection, operation, regulation. Components, characteristics and operation of flow engineering systems. Blower and control elements. Application of fluid principles in solving special industrial problems. Industrial case studies, covering both gaseous and liquid working media. Practical projects. To acquaint students with the theoretical and practical background of technical, mainly acoustic problems in mechanical engineering practice. Presentation of acoustic measuring devices and measurement methods, acquisition of independent measurement tasks, acquisition of measurement technical skills in field and laboratory conditions.

2.2. Learning outcomes

Competences that can be acquired by completing the course:

A. Knowledge

- It provides an overview of the theoretical foundations of industrial ventilation, with special regard to the classification, types, characteristics and areas of application of fans serving ventilation systems.
- He knows the theoretical foundations of industrial ventilation, with special regard to the tasks, operating characteristics and quantifiable characteristics of the systems served by the fans.
- He was informed about the many technological processes that include flow engineering processes, their needs and critical operating characteristics, diagnostic needs and methods, for both gaseous and liquid working media.
- He was informed about the regulation setting the energy requirements for fan operation (fan efficiency).
- He knows the basic measurement and modeling test methods of fans and ventilation systems.
- Understands the basic design principles of radial and axial flow fans.
- He was informed about modern trends in fan development and their practical manifestations (eg paddle shapes).
- It recalls basic wave acoustic modeling methods describing sound propagation.
- Knows methods for wave acoustic modeling of bounded spaces for 1D and 3D cases.
- He has a comprehensive knowledge of the wave acoustic relationships used to describe the propagation of sound in pipes and channels.
- He is aware of the relationships for the analytical calculation of the radiation characteristics of simple sound source models.
- He is aware of design methods related to the noise generation of fans, wind turbines and internal combustion engines, as well as the design of quiet equipment.
- Understands the physical cause of dissipative losses during sound propagation, the basic equations for calculating losses, and the relationships for practical calculation.
- Describes the devices for measuring, signal processing and calibrating the sound pressure level, the characteristics of the various acoustic measuring fields.

- It recalls the measurement methods for determining the ambient noise load and the sound power level emitted.

B. Ability

- Capable of selecting fans for a given ventilation task by performing basic calculations, taking into account and weighing various quantified characteristics at the same time.
- Develops flow engineering project organization skills through interactive industry case studies; by expressing a critical opinion, outlining solution proposals (solution variants).
- Prepares catalog data and price decisions for air conditioning machines for comparative analysis and selection decision-making.
- He plans the content and time plan of the practical project received as a group task, together with his colleagues.
- He makes a proposal to solve the problems that arise during the practical project.
- Able to summarize the results of the project in the framework of a technical report or measurement report.
- Prepares and presents a presentation summarizing the results of the project, also for fellow students. He raises critical questions about other presentations. It strives to answer critical questions and comments concerning the presentation.
- Capable of calculating the sound field of sound sources in free and confined space, of determining acoustic natural frequencies in 1D and 3D cases, of determining the noise load caused by sound sources.
- Prepares a numerical acoustic simulation suitable for setting up a physical model and selecting a solving equation.
- Performs sound propagation calculations in various channel systems, design of simple reactive silencers.
- Performs calculation of sound power emitted by simple sound sources, determination of acoustic model of complex sound sources and model calculations.
- Outline design and operation considerations for quiet operation of fans, wind turbines, and internal combustion engines.
- For open source noise sources, it calculates propagation losses.
- Selects the measuring device suitable for the basic technical acoustic measurement task together with the structure of the measuring system and the measurement.
- At a basic level, it applies the principles of environmental noise testing and determination of emitted sound power levels.

C. Attitude

- He constantly monitors his work, results and conclusions.
- It continuously expands your knowledge of technical fluid flow, acoustics and noise protection.
- Open to the use of information technology tools.
- It seeks to become familiar with the instrumentation required for flow engineering and acoustic design and measurement.
- It develops your ability to provide accurate and error-free problem solving, engineering precision and accuracy.
- It applies the principles of energy efficiency, sustainability and environmental awareness in solving flow engineering, acoustic and noise protection tasks.
- It monitors changes in the social, economic and political system.
- He publishes his results in accordance with his professional rules.
- It is in line with the expectations and requirements of engineering ethics. It publishes its opinions and views without offending others. If necessary, even in the form of a written statement, it undertakes and maintains confidentiality in relation to the projects.
- He takes a critical and self-critical approach in his engineering work.

D. Independence and responsibility

- Collaborates with the instructor and fellow students to expand knowledge.
- Accepts well-founded professional and other critical remarks.
- In some situations, as part of a team, you work with your fellow students to solve tasks.
- With his knowledge, he makes a responsible, informed decision based on his analyzes.
- He feels responsible for the technical flow, acoustics and noise protection problems, as well as the sustainable use of the environment, as well as present and future generations.
- He is committed to innovative methods of problem solving and systematic thinking.
- He feels a responsibility to pass on engineering knowledge to younger generations in terms of professional education.
- He defends his position in professional debates on the basis of rational arguments and counter-arguments.
- He feels responsible for the responsible execution of engineering tasks, occasionally for the creation of long-term engineering jobs.
- It is committed to an entrepreneurial approach that goes beyond task execution, adapting to the integration of engineering tasks into innovative R & D & I activities (basic research, applied research and development-innovation) and the competitive sector.

2.3. Teaching methodology

A) The teaching of the applied fluid science subject part takes place within the framework of lectures (2 hours / week) and classroom practice (1 hour / week). Theoretical knowledge and computational tasks are presented in the lectures. Interactive industry case studies and creative practice projects are developed during classroom exercises. B) The teaching of the applied acoustics part takes place in the framework of lectures (2 hours / week) and laboratory practice (1 hour / week). Theoretical knowledge and computational tasks are presented in the lectures. Laboratory exercises allow a deeper understanding of the acoustic phenomena presented in the lectures and the acquisition of basic applied acoustic measurements.

2.4. Support materials

a) Textbooks

APDowling, JEFoowcs Williams: Sound and Sources of Sound, Ellis Horwood Limited, 1983. (1990) ISBN 0470273704

Leo L. Beranek: Noise and Vibration Control, Institute of Noise Control Engineering, 2nd edition 2005. ISBN 9780471449423

Tamás Lajos: The basics of fluid dynamics. 2015. ISBN 978 963 12 2885 4.

b) Lecture notes

Vad, J., Advanced flow measurements. Technical University Publisher, 2008. Reference: 45085. ISBN 978 963 420 951 5.

c) Online materials

http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNG03

2.5. Validity of the course description

Start of validity:	2021. May 31.
End of validity:	2024. December 31.

II. SUBJECT REQUIREMENT

3. ACHIEVEMENT CONTROL AND EVALUATION

3.1 General rules

A) The evaluation of the study results in the applied fluid science subject part is based on the following: A1) Theoretical indoor dissertation. A2) Industrial problem solving (calculation) indoor dissertation. A3) Technical report prepared from a group practical project. A4) Presentation of a group practical project. A5) Exam paper. B) In the applied acoustics subject part, the study results are evaluated on the basis of the following: B1) Measurement report - 1. B2) Measurement report - 2. B3) Exam paper. C) If the total result of the mid-term performance assessment [A1), A2), A3), A4)] in the applied fluid science course part reaches 70%, an exemption from the A5) examination paper can be obtained with the consent of the student. The minimum requirement for ALL of the above performance marks [A1), A2), A3), A4), A5), B1), B2), B3)] is SPECIFIC, 40% of the maximum sub-score that can be awarded. fulfillment.

3.2 Assessment methods

A. Detailed description of mid-term assessments

1. Mid-term assessment

type: formative assessment, simple

count: 2

purpose, description: Aim: to assess subject knowledge and its ability to apply it creatively by calculation, as follows. Applied Fluid Mechanics Course Part: A1) Theoretical indoor dissertation, based on a series of items covering the topics of industrial ventilation, also referring to the jointly processed industrial case studies. Maximum score: 15. A2) Industrial problem-solving (calculation) in-house dissertation: a problem-solving problem that allows for a recommended aid as well as any other aid. Maximum score: 15.

2. Mid-term assessment

type: formative assessment, simple

count: 2

purpose, description: Aim: to examine the material knowledge related to an independently developed practical project and measurements, as well as the existence of learning outcomes belonging to the attitude group of attitude, autonomy and responsibility, in a small group, in the following way. A) Applied fluid science course part: elaboration of a creative practical project and preparation of a technical report on this A3) by the deadline. Maximum score: 15. B) Applied acoustics course part: personal measurement of two measurements (one on-site and one in the laboratory) and preparation of a consolidated report on these B1) B2) on time. Maximum score: 10.

3. Mid-term assessment

type: formative assessment, project-based, complex

count: 1

purpose, description: Aim: to examine the material knowledge related to an independently developed practical project in a small group, as well as the existence of learning outcomes belonging to the attitude, autonomy and responsibility competence group, in the following way. Oral, slide-based summary A4) of the practical project and its discussion, to practice and develop the student's presentation skills, discussion skills, critical approach, also for other groups. Maximum score: 5.

B. Detailed description of assessments performed during the examination period (if relevant)

Elements of the exam:

1. written partial exam

obligation: mandatory (partial) exam unit, failing the unit results in fail (1) exam result

description: If the total result of the mid-term performance assessment [A1), A2), A3), A4)] in the applied fluid science course part does not reach 70%, the subject can be assessed with a maximum of 70 points by completing a written examination paper [items A5) and B3) can be closed, which consists of the following parts. A5) Applied fluid science course part: theoretical questions, derivation, simple calculation, from the topic of industrial ventilation. Maximum score: 30. B3) Applied acoustics course part: short theoretical and measurement question, derivation, problem to be solved numerically. Maximum score: 40.

2. oral partial exam

-

3. practical partial exam

-

4. inclusion of mid-term results

obligation: mandatory (partial) exam unit, failing the unit results in fail (1) exam result

description: The following mid-year results are included in the exam mark: A) Applied Fluid Science course part: Score of the A1) and A2) dissertations, IF the student has been exempted from the A5) exam dissertation part. A3) Technical report prepared from a group practical project. Maximum score: 15. A4) Presentation of a group practical project. Maximum score: 5. B) Technical acoustics course part: B1) Measurement report - 1. Maximum score: 5. B2) Measurement report - 2. Maximum score: 5.

3.3 The weight of mid-term assessments in signing or in final grading

identifier	**weight**
1 . Mid-term assessment	50 %
2 . Mid-term assessment	40 %
3 . Mid-term assessment	10 %

The condition for signing is that the score obtained in the mid-year assessments is at least **40%**.

3.4 The weight of partial exams in grade (if relevant)

type	**weight**
written partial exam	70 %
oral partial exam	0 %
practical partial exam	0 %
inclusion of mid-term results	30 %

3.5 Determination of the grade

grade ● [ECTS]	**the grade expressed in percents**
very good(5) ● Excellent [A]	above 90%
very good(5) ● Very Good [B]	85% .. 90%

good(4) ● Good [C]	70% .. 85%
satisfactory(3) ● Satisfactory [D]	55% .. 70%
sufficient(2) ● Pass [E]	40% .. 55%
insufficient(1) ● Fail [F]	below 40%

The lower limit specified for each grade already belongs to that grade.

3.6 Attendance and participation requirements

Must be present at at least **70%** (rounded down) of lectures.

At least **70%** the exercises (rounded down) must be actively attended.

At least **70% of** laboratory practices (rounded down) must be actively attended.

3.7 Special rules for improving, retaken and replacement

The special rules for improving, retaken and replacement shall be interpreted and applied in conjunction with the general rules of the CoS (TVSZ).

Can the submitted and accepted partial performance assessments be resubmitted until the end of the replacement period in order to achieve better results?

NO

Taking into account the previous result in case of improvement, retaken-improvement:

new result overrides previous result

The way of retaking or improving a partial assessment for the first time:

partial assesment(s) in this group cannot be improved or repeated, the final result is assessed in accordance with Code of Studied 122. § (6)

Completion of unfinished laboratory exercises:

missed laboratory practices must be performed in the teaching term at pre-arranged appointment

Repetition of laboratory exercises that performed incorrectly (eg.: mistake in documentation):

incorrectly performed laboratory practice (e.g. Incomplete/incorrect report) can be corrected upon improved re-submission

3.8 Study work required to complete the course

Activity	**hours / semester**
participation in contact classes	84
mid-term preparation for practices	7
preparation for laboratory practices	14
elaboration of a partial assessment task	46
exam preparation	49
additional time required to complete the subject	10
summary	**210**

3.9. Validity of subject requirements

Start of validity: 2020. February 14.

End of validity: 2024. December 31.

4. ADDITIONAL INFORMATION

4.1 Primary course

The primary (main) course of the subject in which it is advertised and to which the competencies are related:

mechanical engineering

4.2 Link to the purpose and (special) compensations of the Regulation KKK

This course aims to improve the following competencies defined in the Regulation KKK>

a) knowledge

- Student is familiar with the general and specific mathematical, scientific and social principles, rules, contexts and procedures needed to operate in the field of engineering.
- Student has the knowledge of the theories and contexts of fundamental importance in the field of engineering and of the terminology which underpins them.
- Student has the knowledge of metrology and measurement theory in the field of mechanical engineering.

b) ability

- Student has the ability to apply the general and specific mathematical, scientific and social principles, rules, relationships and procedures acquired in solving problems in the field of engineering.
- Student has the ability to contribute original ideas to the knowledge base in the field of mechanical engineering.
- Student has the ability to apply and develop procedures, models and information technologies used in the design, organisation and operation of engineering systems and processes.

c) attitude

- Student strives to meet and enforce quality standards.
- Student strives to plan and carry out tasks to a high professional standard, either independently or in a team.
- Student is open and receptive to learning, embracing and authentically communicating professional, technological development and innovation in engineering.

d) independence and responsibility

- Student acts independently and proactively in solving professional problems.
- Student takes responsibility for the sub-processes under student's management.
- Student has the ability to work independently on engineering tasks.

4.3 Prerequisites for completing the course

Knowledge type competencies

(a set of prior knowledge, the existence of which is not obligatory, but greatly facilitates the successful completion of the subject)	-

Ability type competencies

(a set of prior abilities and skills, the existence of which is not obligatory, but greatly contributes to the successful completion of the subject)	-